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10/577,733	05/02/2006	Li-Qun Xu	36-1988	5171

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EXAMINER	
DRENNAN, BARRY T	

ART UNIT	PAPER NUMBER
2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/577,733	XU ET AL.	
	Examiner	Art Unit	
	Barry Drennan	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 February 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8,10,13-21,23 and 25-38* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,10,13-21,23 and 25-38* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 May 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/12/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The amendment received 12 February 2009, cancelling claims 9, 11, 12, 22, and 24, and adding new claims 25-38, has been entered. Accordingly, claims 1-8, 10, 13-21, 23, and 25-38 are pending in the application.

Response to Arguments

2. Applicant has amended the title of the specification in response to the objection to the specification for the title being insufficiently descriptive. Accordingly, the objection to the specification on this basis is withdrawn.

3. Applicant has amended the specification in response to the objection to the drawings for having reference numerals that did not correspond in the drawings and specification, by changing the step numbers to correspond to those step numbers presented in the drawings. Accordingly, the objection to the drawings on this basis is withdrawn.

4. Applicant has amended claim 1 in response to the rejection under 35 U.S.C. 101 as being drawn to nonstatutory subject matter, as the original claim 1 recited a method that was not tied to a particular apparatus and did not recite an eligible transformation. The amended claim, indicating that each step is performed “utilizing a computer”, is tied

in a substantial way to the recited apparatus of a computer. Accordingly, the rejections of claims 1-8 and 10 under 35 U.S.C. 101 on this basis are withdrawn.

5. The rejections of claims 10 and 12 under 35 U.S.C. 101 are rendered moot by the cancellation of those claims.

6. With regard to claim 13 and its dependent claims 29-38, no rejection under 35 U.S.C. 101 is being made at this time. Examiner construes the “computer readable storage medium” in accordance with the class of the examples provided in the specification (that is, not limiting it to the specific examples, but using the examples to imply a particular class of media); in particular, only physical computer readable media are mentioned in the specification, and Examiner therefore excludes from the scope of the claims’ construction nonstatutory media such as signals, carrier waves, transmission lines, networks, etc.

7. Applicant has amended claim 1 in response to the rejection under 35 U.S.C. 102(b) as being anticipated by Park et al., "Segmentation and tracking of interacting human body parts under occlusion and shadowing," Proc. Workshop on Motion and Video Computing, pp. 105-111 (published 5 December 2002, hereinafter **Park**).

In particular, amended claim 1 now includes the limitations previously recited in now-cancelled claims 9 and 11, which were rejected under 35 U.S.C. 103(a) as being obvious over Park in view of Lo et al. (cited below), and Park in view of Sittler, R.W.

(cited below), respectively. However, as the scope of amended claim 1 is different from any claim rejected in the prior Office action, a new ground of rejection necessitated by the amendment is made below, and the arguments made by Applicant relative to claims 1-8 and 10 are therefore moot.

8. Applicant has amended claims 13 and 14 in similar fashion to claim 1, so the same analysis given above for claim 1 applies to claims 13 and 14, as well as dependent claims 15-21 and 23.

9. Applicant has argued concerning claim 7 that Magarey, J.F.A., U.S. Patent 7,177,446 B2 (filed as application 10/207,140 on 30 July 2002, and published as U.S. Patent Application Publication 2003/0053661 A1 on 20 March 2003, hereinafter **Magarey (Patent)**) does not teach the limitations of claim 7 that are not disclosed by Park. While Examiner's prior explanation of how Magarey addresses the limitations of claim 7 was flawed, Magarey still teaches the limitations of claim 7 not disclosed by Park. A more detailed explanation of the pending rejection appears below.

10. New rejections necessitated by the entry of new claims 25-38 are also made in this Office action.

11. Following are the objections and rejections pending in the current application.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. Claims 1-4, 10, 13, 14-17, 23, 29-31, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al., "Segmentation and tracking of interacting human body parts under occlusion and shadowing," Proc. Workshop on Motion and Video Computing, pp. 105-111 (published 5 December 2002, hereinafter **Park**), and further in view of Blackman et al., U.S. Patent 5,414,643 (issued 9 May 1995, hereinafter **Blackman**).

14. With respect to claim 1, Park discloses a method for tracking objects in a sequence of video images, comprising the steps of:

storing object models relating to objects detected in previous video images of the sequence, the object models comprising values of characteristic features of the detected objects and variances of those values (**inherent in the formation of blob-based object models and subsequent processing of those models for object tracking, section III**);

receiving a further video image of the sequence to be processed (**inherent in the tracking of blobs throughout a video image, section III**);

detecting objects in the received video image (**"A Gaussian mixture model is used to classify individual pixels…. Markov Random Field framework is used at**

the blob level to merge the pixels.... The blobs are then grouped to form the meaningful body parts by a simple body model," section I);

determining characteristic features of the detected objects (**unary, binary, and tertiary features listed in section III.B**);

calculating a distance measure between each detected object and each object model on the basis of the respective characteristic features using a distance function which takes into account at least the variance of the characteristic features (**Eq. 9, 10, 11**);

matching the detected objects to the object models on the basis of the calculated distance measures (**Fig. 3**); and

updating the object models using the characteristic features of the respective detected objects matched thereto (**Fig. 5**).

Park does not *explicitly* disclose using a computer to perform the steps utilizing a computer, nor does Park disclose that, if a detected object is not matched to an object model then a new object model is stored corresponding to the detected object, and

that the method further comprises counting, utilizing the computer, the number of consecutive video images for which each object is tracked, and outputting, utilizing the computer, a tracking signal indicating that tracking has occurred if an object is tracked for a predetermined number of consecutive frames.

However, Park implies the use of a computer to perform the method (**e.g., the authors work in the "Computer and Vision Research Center" at the "Department of Electrical and Computer Engineering, first page**).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Park by performing the method on a computer, as implied by Park, motivated by the need to dramatically reduce the extreme length of time that performing such a method manually would entail.

Furthermore, Blackman teaches storing a new object model if a detected object is not is not matched to an object model (**table II shows that new track 11+ was added to the track list because it did not match a primary track, col. 7 lines 12-62**). Blackman also teaches counting the number of consecutive video images for each object (**col. 4 lines 12-22, indicating counting number of images out of the previous five consecutive images for each track**) and outputting a track signal (**the universal track list itself, Fig. 11**) when the object is tracked for a predetermined number (**four, col. 4 line 20**) of consecutive frames.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the modified method of Park by adding new tracked objects to the list if not matched to a previous tracked object and by outputting a track signal when a new object has been tracked for a sufficient number of consecutive frames, motivated by the need to track multiple independent objects and to eliminate noise and spurious detections.

15. With respect to claim 2, Park and Blackman disclose the method according to claim 1, and Park further teaches that the distance measure is a scaled Euclidean distance (**Eq. 9, 10, 11**).

16. With respect to claim 3, Park and Blackman disclose the method according to claim 2, and Park further discloses that the distance function is of the form:

$$D(l,k)=\sqrt{\sum_{i=1}^{N}\frac{(x_{li}-y_{ki})^2}{\sigma_{li}^2}}$$

for object model l and detected object k, where x_{li} and y_{ki} are values of the characteristic features of a stored object model and a detected object respectively, σ_{li}^2 is the corresponding component of the variance of each feature, and the index i runs through N features of an object model (**mathematically equivalent to Eq. 11**).

17. With respect to claim 4, Park and Blackman disclose the method according to claim 1, and Park further discloses that the distance measure is the Mahalanobis distance (**Eq. 11**).

18. With respect to claim 10, Park and Blackman disclose the method according to claim 1. Blackman further discloses deleting an object model when the object has not been tracked for a number of consecutive frames (**col. 7 lines 26-29 and Table III**).

19. Claims 13, 29-31, and 36 are rejected for the same reasons given above for the corresponding method in claims 1-4 and 10 above, respectively.

20. Claims 14-17 and 23 are rejected for the same reasons given above for the corresponding method in claims 1-4 and 10 above, respectively.

21. Claims 5, 18, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park and Blackman as applied to claims 1, 14, and 13 above, respectively, and further in view of Marcenaro et al., "Multiple Object Tracking under Heavy Occlusions by Using Kalman Filters Based on Shape Matching," Proc. 2002 Int'l. Conf. on Image Processing, Vol. 2 pp. 341-344 (published 22 September 2002, hereinafter **Marcenaro**).

22. With respect to claim 5, Park and Blackman disclose the method of claim 1, but do not disclose predicting the values of characteristic features of object models for the received frame.

However, Marcenaro discloses using a Kalman filter, which predicts the values of characteristic features and then uses those feature predictions to update the object models (**section 4**).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the invention of Park and Blackman with the application of the Kalman filter as disclosed by Marcenaro, motivated by the reduction in sensitivity to noise that the Kalman filter provides, a property of Kalman filters that is well known in the art..

23. Claims 18 and 32 are each rejected for the same reasons given above for the corresponding method in claim 5.

24. Claims 6, 19, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park and Blackman as applied to claims 1, 14, and 13 above, respectively, and further in view of Harville, U.S. Patent 7,003,136 B1 (filed as application 10/133,151 on 26 April 2002, hereinafter **Harville**).

25. With respect to claim 6, Park and Blackman disclose the limitations of claim 1, but do not disclose increasing the variances of characteristic feature values when an object model is not matched to a detected object.

However, Harville discloses incrementing the state variances when no detected object is matched to an object model (**col. 14, lines 17-22**).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the invention of Park and Blackman with the increase in state variances disclosed by Harville, motivated by the need to decrease the level of tracking confidence for the person (**Harville, col. 14 lines 20-21**) and to accommodate a larger valid area for reacquiring the tracked object.

26. Claims 19 and 33 are each rejected for the same reasons given above for the corresponding method in claim 6.

27. Claims 7, 20, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park and Blackman as applied to claims 1, 14, and 13 above, respectively, and further in view of Magarey, U.S. Patent 7,177,446 B2 (filed as application 10/207,140 on

30 July 2002 and published as U.S. Patent Application Publication 2003/0053661 A1 on 20 March 2003, hereinafter **Magarey (Patent)**).

28. With respect to claim 7, Park and Blackman disclose the limitations of claim 1, but do not disclose updating the characteristic feature values with the average values found over a predetermined number of previous images whenever the object model is not matched with a detected object.

However, Magarey (Patent) discloses updating reference data with the average of feature vectors of prior frames when determining that the track of the feature has been lost. When track is lost, the state is updated with the predicted state vector (**col. 9 lines 46-54**). The last two elements of this vector, the velocity (corresponding to the characteristic feature values), is calculated in **Eq. 12**. As can be seen from matrix D (**Eq. 3**), the bottom two rows of the output are equal to the velocity at the previous frame. Therefore, the characteristic feature values (velocity) are updated with the average values found over *one* previous image whenever the object model is not matched with a detected object (i.e., tracking is lost).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the invention of Park and Blackman with the average value update of Magarey (Patent), motivated by the need to update the tracked object with a feature vector representative of its past behavior in order increase the likelihood of reacquiring tracking at a later time.

29. Claims 20 and 34 are each rejected for the same reasons given above for the corresponding method in claim 7.

30. Claims 8, 21, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park and Blackman as applied to claims 1, 14, and 13 above, respectively, and further in view of Senior et al., “Appearance Models for Occlusion Handling", Proc. 2nd IEEE Int'l. Workshop on Performance Valuation of Tracking and Surveillance, pp. 108-115 (published 9 December 2001, hereinafter **Senior**).

31. With respect to claim 8, Park and Blackman disclose the limitations of claim 1, but do not disclose considering an object to be occluded if an overlap with another object is detected.

However, Senior discloses the determination of occlusion when objects overlap (**Fig. 4, 5, and section 6**), and further describes the resolution of such occlusion determinations.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the invention of Park and Blackman with the occlusion resolution of Senior, motivated by the increased accuracy of tracking when the tracking process can distinguish at least partially from among overlapping objects, a necessity when dealing with real world scenarios (**Senior, abstract and section 1**)..

32. Claims 21 and 35 are each rejected for the same reasons given above for the corresponding method in claim 8.

33. Claims 25, 27, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park and Blackman as applied to claims 1, 14, and 13 above, respectively, and further in view of Waters et al., U.S. Patent 6,256,046 B1 (issued 3 July 2001, hereinafter **Waters**).

34. With respect to claim 25, Park and Blackman disclose the method according to claim 1. Park further discloses that the characteristic features comprise features describing the shape (**border pixel set, Sec. III.B.**) and color (**mean intensities of HSV color components, Sec. III.B.**) of each detected object.

Neither Park nor Blackman disclose that the characteristic features comprise the velocity of each detected object.

However, Waters teaches tracking the velocity of a blob object (**col. 4 line 65 through col. 5 line 13**).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Park and Blackman by including the velocity of the object in the characteristic features, as taught by Waters, motivated by the ability to discern, for example, “intent” of the represented object (**Waters, col. 5 lines 10-13**).

35. Claims 27 and 37 are each rejected for the same reasons given above for the corresponding method in claim 25.

36. Claims 26, 28, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park, Blackman, and Waters as applied to claims 25, 27, and 37 above, respectively, and further in view of Zhou et al., "Tracking and classifying moving objects from video", Proc. 2nd Int'l Workshop on Performance Evaluation of Tracking and Surveillance (published during or before December 2001, hereinafter **Zhou**) and Durnell, L., International Patent Application Publication WO 03/017203 A1 (published 27 February 2003, hereinafter **Durnell**).

37. With respect to claim 26, Park, Blackman, and Waters disclose the method of claim 25, wherein the characteristic features comprise the velocity (**Waters, col. 4 line 65 through col. 5 line 13**), size (**number of pixels in the blob, Park, Sec. III.B.**), and dominant color representation (**mean intensities of HSV color components, Park, Sec. III.B.**).

None of Park, Blackman, and Waters teaches the inclusion of the major axis to minor axis ratio of the best-fitting ellipse or the orientation of the major axis of the ellipse.

However, Zhou teaches tracking the orientation of the major axis of the ellipse (**"Object orientation is defined as the angle between the major axis and the horizontal axis", Sec. 3**), and Durnell teaches tracking the aspect ratio, or the ratio of the minor axis to the major axis (**p. 6**; this is simply the reciprocal of the ratio calculated in the present application, and would have been obviously interchangeable to an ordinary artisan at the time of the invention).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Park, Blackman, and Waters by including the ellipse orientation and aspect ratio in the characteristic features, representing the application of a known technique to a known method to obtain predictable results.

38. Claims 28 and 38 are each rejected for the same reasons given above for the corresponding method in claim 26.

Conclusion

39. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Auty et al., U.S. Patent 5,809,161.

Abbott et al., U.S. Patent 5,999,634.

Collins et al. “Algorithms for cooperative multisensor surveillance.” Proc. IEEE, Vol. 89 No. 10, pp. 1456-1477.

40. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Barry Drennan whose telephone number is 571-270-7262. The examiner can normally be reached on Monday through Thursday, 9am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on 571-272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Barry Drennan/
Examiner, Art Unit 2624

/Vikkram Bali/

Supervisory Patent Examiner, Art Unit 2624